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ABSTRACT

Influence of class size on student performance was tested by comparing two homogeneously grouped sections of ninth grade students. Students were randomly assigned to two sections, one numbering 46, the other 23. Both sections were taught Introductory Physical Science (IPS) for a period of six months. Standardized test results could not be used to reject the null hypothesis that no significant differences existed between large and small classes in terms of achievement. Possible explanations and individual scientific research implications are discussed. (CS)

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# The Influence of Class Size on Student Performance in a Secondary School Science Laboratory[1]

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Class Size Influences

1 This study was conducted as a Masters Degree Research Project at Beaver College, Robert J. Wright Major Advisor.



SE 022 518

Abstract

The Influence of Class Size on Student Performance in a Secondary School Science Laboratory

In this study the influence of class size to student performance was tested by comparing two homogeneously grouped sections of nineth grade science. One section held 46 students, in the other 23. Student performance for nineth grade was measured for each class by a standard achievement test. After six months of instruction, no significant differences were found in terms of overall student achievement. Possible explanations for these results are discussed and individual science research implications are presented.

## Introduction

Class size is a frequent source of friction between teachers and administrators. In any debate on the topic of class size both parties must consider student performance as one critical criterion. However, the literature dealing with optimum class size is a paradoxical one (Hubbard, 1963; Johnson, 1973; NEA Symposium, 1976; Stennett, 1973). The optimum size of a class seems to be related to a number of other factors including method of instruction, nature of the content being taught, the ability and age of the students involved.

On the elementary level Manos (1974) found a 20% variance in achievement that could be explained by class size and three measures of teacher behavior. In this study it was concluded that class size was negatively related to achievement. In another study of elementary school children Woodson (1968) found that large classes tended to have lower academic achievement.

On the secondary level in science, Anderson (1949) concluded that the size of science classes

was a contributing factor in achievement. In working with high school chemistry Anderson (1950) in two different studies found that lighter pupil loads were related to achievement. There are no recent studies of the effect of class size on achievement in secondary school science.

In other subject areas and grade levels there is no clear resolution of this question of the relationship of class size to achievement. Bostrom (1969) in a study involving college freshmen, investigated class size on critical thinking skills and found that when ability level was considered, meaningful differences in student achievement were a function of class size. However, (Thomas, 1970) in a study involving abilities and critical thinking, concluded that there was no significant difference in achievement of three experimental classes compared on posttest measures to a control group with a rentention test.

In the area of verbal behavior Smith (1975) found that small groups had more direct and indirect verbal behavior than large groups in junior high

school science. Scott (1972) found that group size does not affect student verbal interaction but discussion style (method) employed by the teacher has an influence in English classes.

In introductory classes of business management on the college level, Dock (1970) reported results dealing with two dimensions. In the first of these no statistically significant contribution was made by class size in relationship to student achievement. However, it was noted that a greater number of students in the large class indicated that they felt the suitability of a class their size was extremely poor or below average.

In a study on the effects of class size on skills acquired in typing, Good (1970) found that there was no significant difference in learning achieved in classes of 26 students and 61 students. The larger class students achieved just as well as the smaller class students. The report further recommended that classes of fewer than 60 students be discontinued.

Foregoing research has not yielded any

conclusive findings. The purpose of this study is to focus on the content area of high school science. The unique nature of the discipline with its modern orientation to laboratory activity in the classroom, appears to involve students and teachers with variables not found in other content areas, laboratory equipment being the most notable example.

The following hypothesis was tested: class size influences student performance in a secondary school science laboratory. The high school science laboratory is therefore a content area where the decision to increase or decrease class size could have an influence on student performance.

The term performance in this study was confined to mean achievement on a standardized examination.

## Method

To study the influence of class size on student achievement, two classes of nineth grade students were formed. The average student age was 14 years old. In almost all cases students have spent the first eight years in different parish elementary schools in the same community. For these students

nineth grade was the first year in a large nonpublic high school. For the most part, students attending this school come from working class homes and relatively stable communities.

Scholastic Testing Service (STS) achievement tests, 1975 edition, were used as criteria for forming two experimental classes. Composite scores for all students were in the 45-55 percentile. Students were randomly assigned to both the large and small group from the available population within this percentile range. The first class contained 46 students while the second contained 23. The experimentor taught both sections to eliminate the possibility of teacher differences and method of presentation.

Both sections were taught using the Introductory Physical Science program (IPS) curriculum for a period of six months. This is a laboratory oriented program in which students perform experiments to discover evidence for an atomic model of matter, the atom. (Prentice-Hall, Note 1)

Students worked in pairs with their own set

of equipment. The teacher gave individual attention to those who requested it. Obviously, the time spent with each individual student will be a function of the class size.

The performance of each class was tested at the end of a six month period with standard prescribed achievement tests. (Series C, Note 2) These tests are supplied by the publishers whose research indicates a reliability of .80. (Thompson, Note 3)

Results

The null hypothesis that no significant differences existed between the large and small class in terms of achievement could not be rejected ( $t = .52$ ).

THE INFLUENCE OF CLASS SIZE IN A SECONDARY SCHOOL SCIENCE LABORATORY

| STUDENT PERFORMANCE | N | M | SD | t |
|---|---|---|---|---|
| SMALL CLASS | 23 | 10 | 3 | .52 |
| LARGE CLASS | 46 | 9.5 | 5 | |

The rather surprising finding of this study is that the achievement of students in a science class of 23 is not significantly different from students in a class twice that size. The reason this is somewhat surprising is because of the fact that the smaller group has significantly more opportunity for individual questioning and teacher interaction with students. It would seem however that this increased opportunity for student-teacher interaction does not influence the performance on an objective measure of science achievement.

There are several cautions however that have to be noted in interpreting these data. For one, no attempt was made to assess the students' ability to safely use laboratory equipment. Also, students in this study consisted of a homogeneous group of average ability students. Therefore, results may not generalize to other situations. For example, there is no evidence to indicate that the same result would occur if students of exceptionally high or low ability were to be compared for achievement in classes of different size. Also,

there is no evidence to indicate that this finding would occur if students were grouped heterogeneously. Perhaps in a more mixed environment, achievement would be enhanced for the slower students by the more personal contact which could be provided in a smaller class setting.

Another issue which was not addressed by this study is that which would relate to exceptionally small classes. It is possible that there is an optimal small class size which is below 23 students per section. Therefore it is possible that a class size of 15, or perhaps 10, or even less may result in an optimal level of student achievement. However as class size increases beyond that point, no significant difference with respect to achievement can be found. Inotherwords it is possible that a class of 23 and a class of 46 could have the same levels of achievement and likewise a class of 200 would also have the same achievement level. The answer to this question can only be determined by exploring a wider range of class sizes with respect to this dimension.

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